Aishihik Relicensing Project
Environmental Impact Assessment

— Summary —

January, 1999

YUKON
ENERGY

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— Summary —

This summary outlines the Environmental Impact Assessment (EIA) of the Aishihik Relicensing project. The details of the EIA are presented in nine volumes.

volume 1 — Environmental Impact Assessment

volume 2 — Legislative Requirements and Terms of Reference/ Study Plans

volume 3 — Hydrology Studies

volume 4 — Geomorphology Studies

volume 5 — Wildlife Studies

volume 6 — Aquatic Studies

volume 7 — Heritage Resources Study

volume 8 — Socioeconomic Study

volume 9 — Impact Assessment Supporting Material

Environmental assessment legislation

The environmental assessment has been conducted under the Canadian Environmental Assessment Act (CEAA).

The relicensing of Aishihik is subject to a CEAA 'screening'. The facility is licensed by the Yukon Territory Water Board. The Department of Indian and Northern Development (DIAND), together with the Department of Fisheries and Oceans, will coordinate the review under CEAA. DIAND also administers the *Yukon Waters Act* through the Water Board.

Who owns the Aishihik Generation Station?

Yukon Energy owns the Aishihik Generation Station on Aishihik Lake, northeast of Haines Junction. The Northern Canada Power Commission (NCPC), which was a federal crown corporation, built the facility in 1975. In 1987, ownership was transferred to Yukon Energy.

What's the purpose of the relicensing project?

This relicensing project is to renew and amend Yukon Energy's existing water licence to continue to generate electricity at the Aishihik Generation Station. The water licence regulates water levels and flows from Aishihik and Canyon lakes.

Other than the future addition of a third turbine in the existing powerhouse, no other changes will be made to the existing facility and control structures.

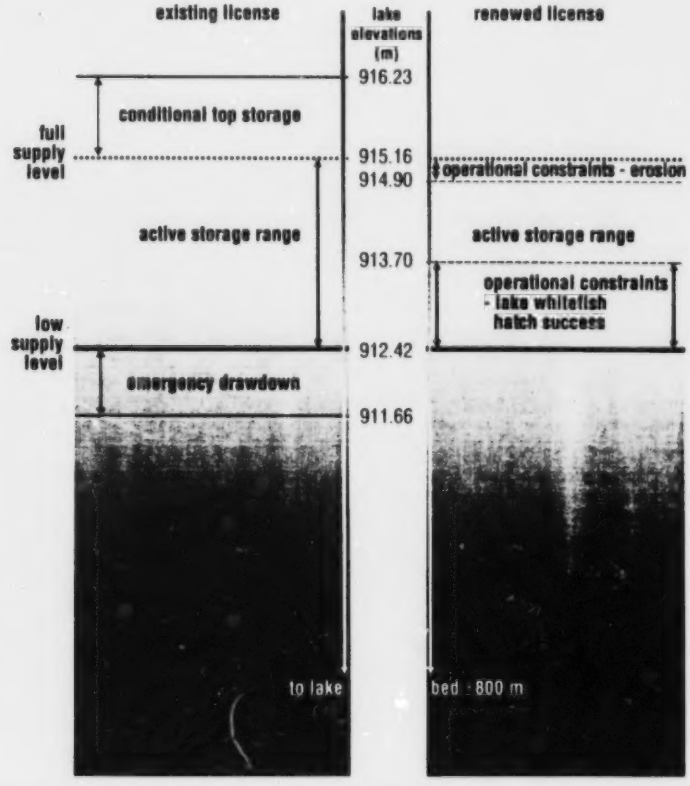
The water used to generate power at the Aishihik facility comes from Aishihik, Sekulmun and Canyon lakes. Sekulmun Lake

provides natural storage; small dams at the outlets of Aishihik and Canyon lakes provide regulated storage on these lakes. Water from Canyon Lake is diverted through a canal to the powerhouse to generate electricity.

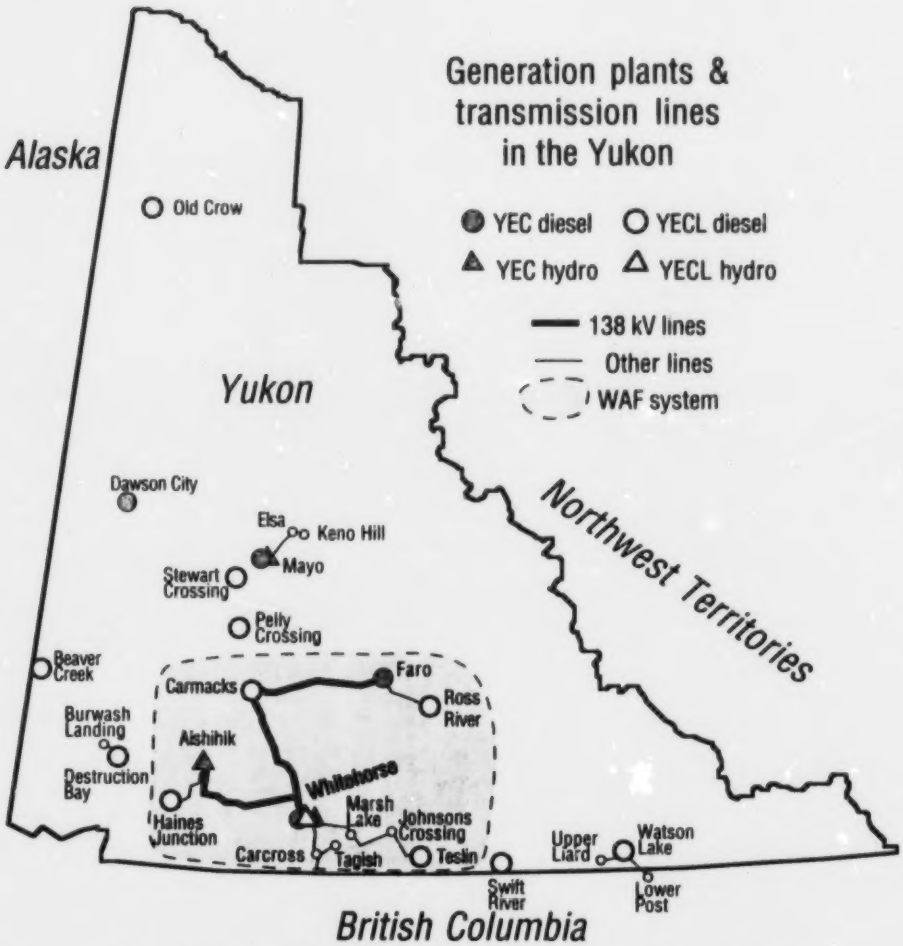
Key features of a renewed water licence

The renewed water licence for which Yukon Energy is applying has 12 key features:

1. a 25-year licence term to provide long-term security of energy supply;
2. a managed storage range on Aishihik Lake of 2.74 m (9 ft.) between lake elevations 912.42 m and 915.16 m;
3. a third turbine of five to seven megawatt capacity installed inside the existing powerhouse at some future date;
4. downstream flows in the upper E. Aishihik River that will continue to support year-round rainbow trout habitat (in accordance with licence amendment June 1996);
5. clearly stated environmental performance objectives in the licence;
6. operational constraints on the use of water to minimize the effects of high water;



7. operational constraints on the use of water to avoid potential significant effects on the lake whitefish fishery as indicated by the monitoring results;
8. annual monitoring of the health of the fishery at Aishihik Lake;
9. conditional measures to address the effects of the project on access to the lake and harvesting;
10. shoreline erosion monitoring at sensitive sites;
11. heritage sites monitoring and possible salvage of those that are at risk from erosion;
12. additional protective and interpretive measures at selected heritage sites.



Whitehorse Aishihik Faro (WAF) System Grid

Why is the Aishihik Generation Station important?

Aishihik generates about 30 per cent of the total hydro energy of the Whitehorse Aishihik Faro (WAF) system. The facility provides electricity to many homes and businesses in the Yukon. Aishihik is unique because its energy can be stored in the form of water from summer to winter, from wet years to dry and from low-demand years to higher-demand years. Energy produced at Aishihik is primarily used for winter generation when the demand for electricity is highest. It is the only hydro facility on the WAF system that has this kind of multi-year storage capability.

This is why we need the capacity of Aishihik to maintain a secure energy supply in the Yukon. As a renewable energy source, it's preferred over non-renewable sources of generation such as diesel.

Yukon Energy will continue to address effects that are 'adverse', 'significant,' or 'likely,' as they are identified in the environmental impact assessment. Yukon Energy's proposed environmental monitoring will confirm and clarify predicted effects that the project may have on the environment as well as identify any new or cumulative effects, if these occur.

Protecting an existing investment in a renewable source of energy

Protecting the existing investment in Aishihik will help to maintain stable energy costs — without Aishihik, new generation sources would be needed, a costly procedure with financial and environmental risks.

The electricity produced at Aishihik is used primarily during winter months, when other sources of energy supply cannot meet the demand on the WAF system. If Aishihik cannot produce enough energy, the electricity required must come from other sources. In recent years, for example, Yukon Energy has made up for shortfalls in energy with diesel generation.

Why is a third turbine proposed?

Presently, there are two 15 megawatt turbines at Aishihik. A third, smaller (5-7 MW) turbine would be located within the existing powerhouse and would accomplish two important goals — make more efficient use of water at Aishihik Lake when demand is low, and reduce the use of diesel on the WAF system when demand is high. Yukon Energy does not have immediate plans to install the third turbine, but the renewed water licence should provide for it.

Has the public been involved in the relicensing project?

Yes. Public involvement in the original development of the Aishihik facility goes back to the early 1970s. Much of this earlier activity took place at Yukon Territory Water Board hearings into the original water license and as recently as the 1996 license amendment.

In March 1993, the Water Board directed Yukon Energy to proceed with studies needed to support a relicensing application. The board also directed Yukon Energy to form a Technical Advisory Group (TAG) of key stakeholders and regulators. This relicensing process officially began in 1993 when relicensing studies began and when TAG was formed.

In 1997, Yukon Energy held open houses in Haines Junction and Whitehorse to present the results of the scientific and socioeconomic studies (these results are in Volumes 3-8). Then, in early 1998, Yukon Energy held a series of *stakeholder* information meetings to present the results of the environmental impact assessment, the key features of the proposed renewed water licence and the comprehensive impact management plan. This year, 1999, Yukon Energy is providing *public* information opportunities on the results of the environmental impact assessment.

How were the Champagne and Aishihik First Nations involved?

Throughout these years, Yukon Energy has maintained contact with the Champagne and Aishihik First Nations. Initially, the first nations' involvement was through participation on TAG. Many Aishihik Lake residents also had direct contact with study team members during the field work. Traditional ecological knowledge about the Aishihik area was part of the socioeconomic study. An Aishihik First Nation member did this work that documented historical and current first nation activity in the study area. This information is integrated into the other studies and the environmental impact assessment.

In 1997, Yukon Energy initiated discussions with the Champagne and Aishihik First Nations to review concerns about the project and to consider how to address them. Then Yukon Energy began a compensation process to redress grievances related to the original construction of the Aishihik Generation Station (by NCPC in 1975) and its operation since then.

Almost 90 people have filed compensation claims. When claims are accepted, they will negotiate compensation under the terms of the NCPC Transfer Agreement of 1987.

What environmental issues were studied?

The studies considered what are called 'valued ecosystem components' (VECs) identified in a three-day TAG workshop in 1993. The VECs include:

- access to water
- aesthetics
- birds
- commercial resource use
- cost of energy
- fish
- furbearers
- other mammals
- native heritage and substance
- recreation and tourism
- shoreline erosion
- water quality
- downstream/transboundary concerns
- threatened/endangered species

What was the impact assessment process?

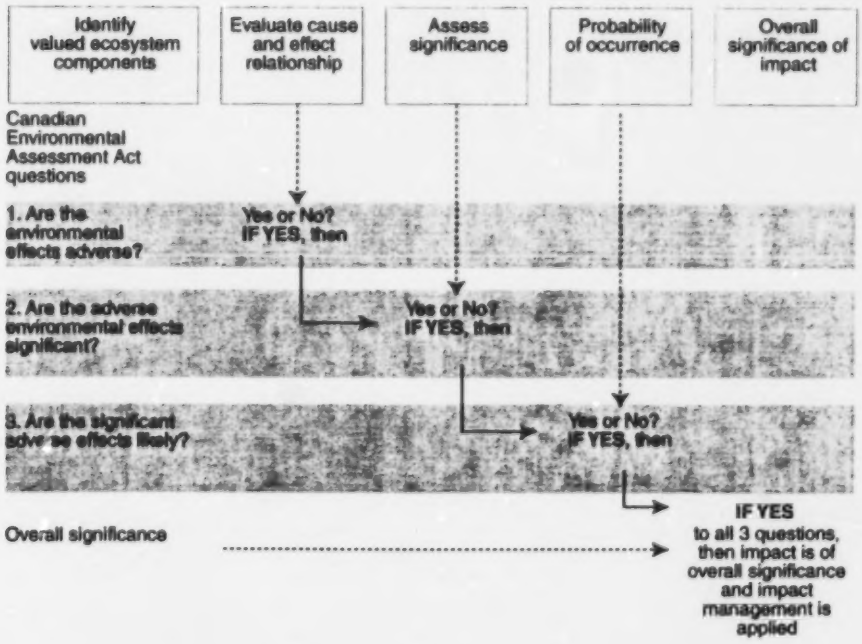
Under CEAA, the assessment of impacts considers three questions, in this order:

- Are the environmental effects adverse?
- Are the adverse effects significant?
- Are the significant adverse effects likely?

The management of Aishihik Lake has been ongoing for over two decades and has provided an opportunity to understand the links between the existing operating regime and the environment. The assumption, at the outset of the relicensing studies, was that the effects on the VECs were linked to the regulation of Aishihik Lake levels.

Where the operating regime was found to directly affect a VEC, this effect was considered 'adverse.' The studies identified 15 adverse effects for the existing operating regime at Aishihik Lake. These effects included such things as access to the lake, lake whitefish spawning, aesthetics, and muskrat survival.

In addition to the existing operating regime, the Impact Assessment examined seven different operating scenarios. (An operating scenario is a simulation of how the Aishihik Lake might be operated, given various storage ranges, operating constraints, and demand for electricity over the next 25 years.) Environmental effects were assessed for each operating scenario to see if there were different ways to manage water levels at Aishihik to minimize potential, significant effects.


Identify valued ecosystem components
Evaluate cause and effect relationship
Assess significance
Probability of occurrence
Overall significance of impact
Canadian Environmental Assessment Act questions
1. Are the environmental effects adverse?
Yes or No? IF YES, then
2. Are the adverse environmental effects significant?
Yes or No? IF YES, then
3. Are the significant adverse effects likely?
Yes or No? IF YES, then
Overall significance
IF YES to all 3 questions, then impact is of overall significance and impact management is applied

How was 'significance' measured?

To determine the significance of the effect, four questions were addressed:

1. Over how large an area does the adverse effect occur?

2. Once triggered, how long do the adverse effects last?

3. How often would the specific lake conditions that result in an adverse effect occur during the next 25 years?

4. Relative to the study area, how big is the effect?

Some adverse effects were found to be significant under certain operating scenarios. Others were not.

Are the significant effects likely to occur?

The third CEAA question — are the significant effects likely? — was answered by a probability analysis to predict whether the occurrence of specific lake conditions that would result in a significant effect are likely. This analysis was done for each operating scenario, and three different forecasts of demand for electricity. The significance and likelihood of effects under each scenario were assessed to determine if one scenario avoided all significant and likely effects. The results showed that no single operating scenario would avoid all significant and likely effects.

What was the best overall choice?

Of the seven scenarios considered, the one that allows the 2.74 m (9 ft.) storage range, together with a comprehensive impact management plan, was selected as the one to be submitted for relicensing. Potentially significant impacts can be effectively managed through specific impact management measures. Some of these measures include constraints on the use of water when lake levels approach the top and bottom of the storage range, fisheries monitoring, shoreline erosion and heritage site and lake access improvements. Maintaining the existing 2.74 m storage range allows for continued, long-term operating flexibility and is the only available and effective way to avoid significant effects on the cost of energy if the storage is less than 2.74 m. Annual monitoring programs will ensure that environmental management objectives are met.

To find out more about the Aishihik relicensing project

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AISHIHIK RELICENSING PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT

TECHNICAL SUMMARY

YUKON ENERGY

January 1999

SUMMARY

INTRODUCTION

The relicensing of the Aishihik Generation Station (AGS) is supported by a thorough assessment of its potential effects. The Aishihik Relicensing studies are presented in nine volumes. This volume contains a summary of all studies, the impact assessment and the impact management plan. The other 8 volumes include the supporting material and technical studies.

The Aishihik Relicensing has been conducted under the Canadian Environmental Assessment Act (CEAA), which came into effect in 1995. Under CEAA, the project is not deemed to be a "regulated project", as the threshold for a regulated hydro project is 200 megawatts (Aishihik is 30 MW). As such, this relicensing will be subjected to a CEAA Screening, and will be relicensed by the Yukon Territory Water Board (YTWB). The Dept. of Indian Affairs and Northern Development (DIAND) is the responsible authority under CEAA. DIAND is also responsible for administering the Yukon Waters Act, through the YTWB.

The owner and manager of the Aishihik Generation Station is the Yukon Energy Corporation (Yukon Energy). The AGS was originally built by the Northern Canada Power Commission (NCPC), which was a federal crown corporation. Ownership was transferred to the Yukon in 1987, at the time of the formation of Yukon Energy.

PROJECT DESCRIPTION

For the purposes of this study, the project is defined as a renewal and amendment of Water License No. Y3L5-0307. The project is described in terms of the conditions that would pertain to a water license issued for regulating the water levels and flows from Aishihik and Canyon Lakes. Other than the addition of a third turbine within the existing powerhouse, the project does not entail the construction, modification or removal of any existing or new structures.

Water used to generate power comes from Aishihik, Sekulmun and Canyon lakes. Sekulmun Lake provides natural storage, and regulated storage is provided by Aishihik and Canyon Lakes. A control structure at the outlet of Aishihik Lake regulates the level of this lake and controls water flow into Canyon Lake. Another control structure at the outlet of Canyon Lake diverts the flows into the power canal which transports water to the powerhouse.

Key Features of a Renewed Water License

The proposed renewed water license will include the following key elements:

- a 25 year license term
- storage range on Aishihik Lake of 2.74 m (9 ft.) between lake elevations 912.42 m and 915.16m
- a third turbine of 5 to 7 MW capacity to be installed in the existing powerhouse
- no change in the storage range at Canyon Lake

- downstream flows in upper E. Aishihik River to continue to support year-round rainbow trout habitat, as per license amendment of June, 1996
- environmental performance objectives articulated in the license
- impact management measures to effectively mitigate high water impacts
- impact management measures, including annual monitoring of fishery, to predict and avoid potential, significant impacts on the lake whitefish fishery
- conditional measures to address access and harvesting impacts
- monitoring of shoreline erosion at sensitive sites
- monitoring and possible salvage of heritage sites at risk of erosion
- additional protective and interpretive measures at selected heritage sites

PROJECT JUSTIFICATION

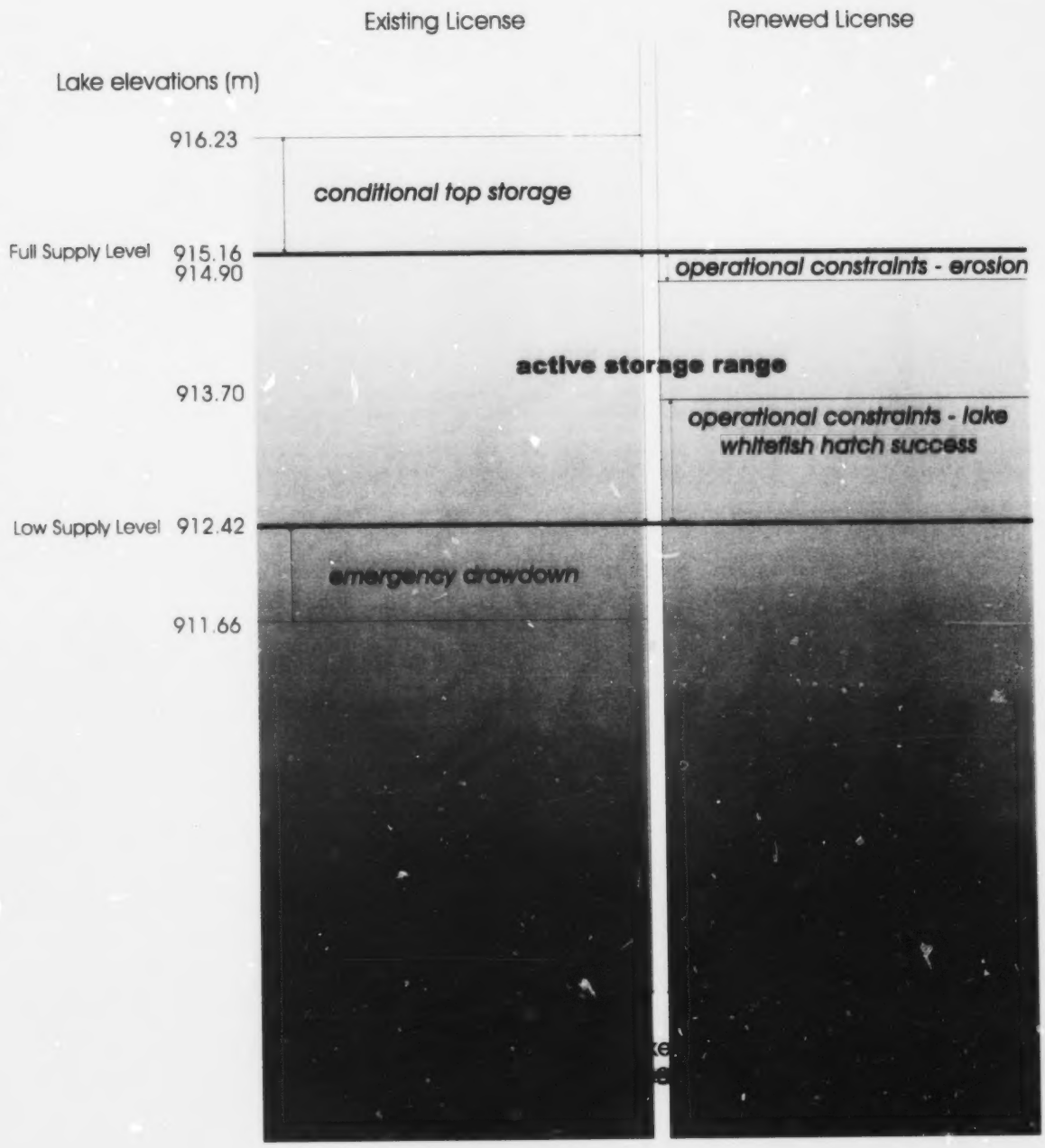
Energy Produced at Aishihik

As a renewable and low cost energy resource, and a key component of the Yukon's existing electrical supply system, Aishihik plays a central role in the provision of electricity to residents, businesses and industry in the Yukon. On a long-term average, Aishihik generates approximately 105 GWh (gigawatt hours) of electricity each year. This represents about 30% of the total hydro energy of the Whitehorse Aishihik Faro (WAF) system. The energy produced at Aishihik is relied upon for winter generation when demand for electricity is greatest. The ability to store energy in the form of water from summer to winter, and from wet years to dry, and from years when demand is low to years when it is higher, is a unique and valuable feature of Aishihik. Currently, Aishihik is the only hydro facility on the WAF system with a significant multi-year storage capability.

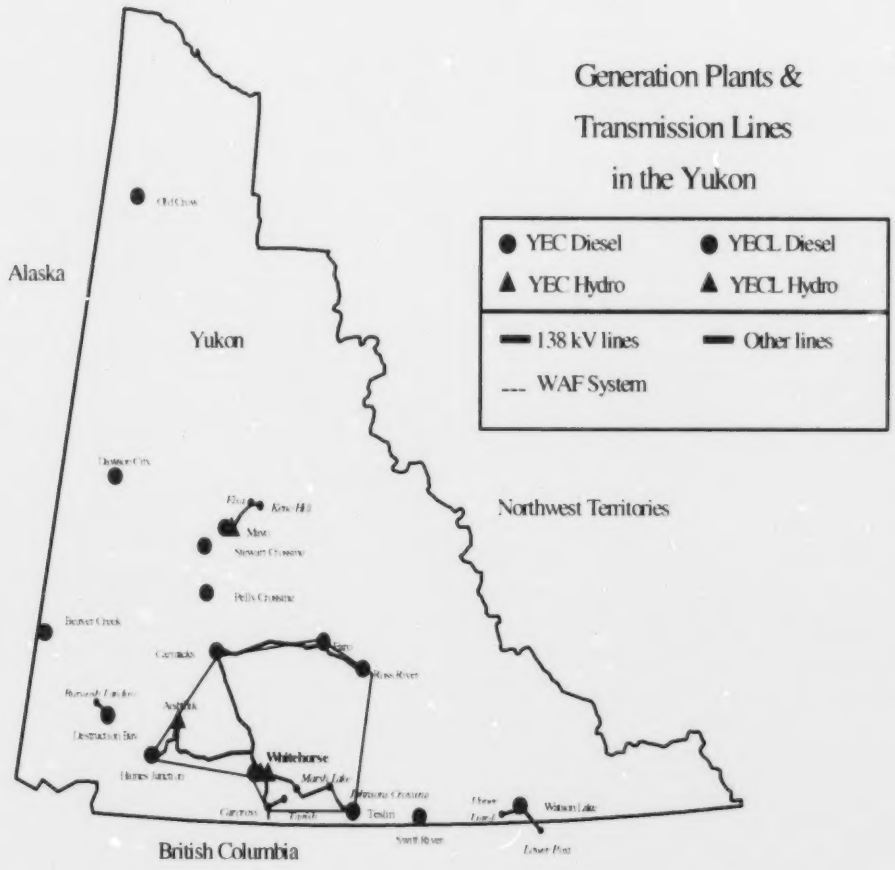
Relicensing Objectives

Yukon Energy has established objectives for relicensing projects in general, and specific considerations for relicensing Aishihik. These are the key objectives that frame the renewal of the water license:

- Security of energy supply: The existing and long-term generation value of hydroelectric power, including the unique contribution of Aishihik, must be maintained. Aishihik's potential to meet existing and future energy needs of Yukon consumers should be optimized.
- Environmental responsibility: Yukon Energy will address effects that are adverse, significant and likely that are identified in the EIA, and may also address adverse, but not significant or likely effects through mitigation or compensation. Proposed monitoring will confirm and clarify predicted impacts, and identify new or cumulative impacts, if any.



Key Features Of A Renewed Water License



Whitehorse Aishihik Faro (WAF) System Grid

- Preference for renewable energy: Yukon Energy places highest priority on maintaining and enhancing generation from existing facilities rather than on developing new ones, and on renewable energy sources, as opposed to non-renewable sources. Aishihik satisfies both these requirements.
- Costs and rate stability: Yukon Energy wishes to minimize cost pressures that may affect rate stability or accelerate development of new generation sources. Licensing alternatives that would result in higher costs to utilities due to a reduction in energy produced at Aishihik must be acceptable to the Yukon Utilities Board. The existing investment in Aishihik generation must also be protected.
- Public accountability: Public accountability and accessibility are principles that guide the relicensing process. Yukon Energy has and will continue to involve interested people and organizations through public information and consultation. Yukon Energy has established direct communication with government representatives, including the C&AFN government and its Aishihik members.
- Consistency and fairness: Yukon Energy must be aware of the precedents set by the Aishihik relicensing process and its outcome. The consequences of precedents established in this relicensing may be repeated in other, upcoming relicensing projects.

Projecting Demand for Electricity

The energy produced at Aishihik responds to the demand for electricity from year to year, and is generated primarily during the winter months. Aishihik, therefore, operates as the "swing plant", and is used when other sources of supply are inadequate to meet the demand on the WAF system. This is why the storage capability of Aishihik is essential to supplying energy during the winter, particularly when the total demand is high such as occurs during severe winter temperatures, and when the mine at Faro is operating. For the past several years, shortfalls of energy on the WAF system have been made up with diesel generation. Reductions in energy or capacity supplied from Aishihik would need to be replaced by other sources. At present, alternative sources do not exist. The development of new energy sources would create new costs for ratepayers, as well as new environmental and socioeconomic effects.

Justification for a Third Turbine

A third turbine at Aishihik would supply between 5 and 7 MW of capacity at an estimated cost of $7 million. A third turbine of this size would result in more efficient use of water (than can be achieved with the two larger turbines) when demand for electricity is both high and low. Given the importance of Aishihik in supplying winter generation, and the opportunity to enhance the efficient use of water and to displace diesel generation, provision for a third turbine in the renewed license is justified.

CONSULTATION

Public Consultation

The public consultation process identified issues surrounding the relicensing of Aishihik that are of major concern to the public and key stakeholder groups. Public consultation has been an integral part of the relicensing studies, and Yukon Energy is committed to ongoing consultation with the public.

Public involvement in the original development of the Aishihik facility goes back to the early 1970's. Much of this earlier activity took place at various YTWB hearings in connection with the original water license and subsequent amendments to it. In March, 1993, the YTWB directed Yukon Energy to proceed with the proposed program of studies for relicensing, and to form a Technical Advisory Group (TAG) to be made up of key stakeholders and regulators. The formal consultation process began in 1993, at the commencement of relicensing studies and the establishment of TAG. While not a substitute for public consultation TAG nonetheless provided an opportunity for regular contact with key stakeholders. Open houses were held in Haines Junction and Whitehorse in early 1997 to present the results of the scientific and socioeconomic studies. In early 1998, Yukon Energy held a series of information meetings with stakeholders to present the conclusions reached in the impact assessment, the key features of the proposed renewed water license, and an outline of the proposed impact management plan. Yukon Energy intends to hold further consultation with the public on the results of the EIA.

The Technical Advisory Group

TAG representation included interested individuals, organizations, regulatory agencies and governments. The role of TAG was to provide advice and comment on the program of studies, including the scope of studies, methodologies, and other technical aspects. The draft study reports and key elements of the impact assessment were critically reviewed by TAG. TAG also made recommendations on the public consultation process. While TAG was not intended as a substitute for public consultation, its participation in the scope of issues to be studied, the methodologies employed, and ongoing review of the process did provide an opportunity for regular exchange of information with key stakeholders. The list of issues included in the program of studies reflected the broad range of stakeholder concerns expressed since the relicensing process began.

C&AFN Involvement in Relicensing

Yukon Energy and its consultants have had ongoing contact with C&AFN and its Aishihik members throughout the course of the relicensing studies. During the initial years of the study program, the primary forum for C&AFN input was through participation on TAG. Many Aishihik residents had direct contact with the study team members during the field work. During the socioeconomic study, the traditional ecological knowledge about the Aishihik area was documented. This work was done by an Aishihik FN member, and included documentation of

the historical and current First Nation activity in the study area. This work was integrated into the other studies and the impact assessment.

In 1997, Yukon Energy initiated direct discussions with C&AFN to review concerns and consider means to address them. Following these discussions, Yukon Energy provided a research report to assist with the Specific Claim, and initiated a compensation process to redress grievances related to the original construction and subsequent operation of Aishihik. Approximately 60 individuals and their families have filed compensation claims, and are currently being interviewed. Once claims have been accepted, those families and individuals that filed a claim will be entitled to negotiate compensation for those claims, under the terms of the NCPC Transfer Agreement.

ENVIRONMENTAL SETTING

The environmental setting describes the characteristics of the natural resources and socioeconomic conditions within the Aishihik study area. The environmental setting is described in Chapter 5 and has been derived from the studies (Volumes 3 - 8) undertaken for relicensing. The hydrology of the Aishihik-Sekulmun-Canyon lakes system, the effect of Aishihik Lake levels on the Sekulmun ponds and other shallow water environments, and the downstream hydrology is described. The geomorphology of the area, with particular attention to permafrost around the lakeshore, and its important role in shoreline erosion processes is described.

The aquatic environment is described in terms of fish species composition and abundance, with particular reference to lake whitefish biology and habitat utilization. The terrestrial environment, and its importance for waterfowl and aquatic furbearers is described, including identification of the most productive habitats, and the seasonal use of these habitats by these birds and animals.

Human activity in the study area is described, including reference to historical use of the area and its resources, and the fundamental social changes that have occurred in the area since the second World War. Outdoor recreation, especially sport fishing, is also described, with reference to the broader regional context. Heritage sites and grave sites around the shore zone that are potentially affected by the project are identified, with particular attention to those vulnerable to erosion. The WAF system, and the unique contribution of Aishihik to the WAF system, is summarized.

CAUSE AND EFFECT RELATIONSHIPS

Valued Ecosystem Components

Valued ecosystem components (VEC's) are those components of the ecosystem for which there is a strong public and/or professional concern. The process of selecting VEC's to be studied was conducted at a 3 day TAG workshop in 1993. The VEC's that formed the basis of the study designs included:

- access to water
- aesthetics
- birds
- commercial resource use
- downstream/transboundary concerns
- cost of energy
- fish
- furbearers
- mammals, other than furbearers
- native heritage and subsistence
- recreation and tourism
- shoreline erosion
- threatened/endangered species
- water quality

One of the first steps in designing the relicensing studies was to conceptualize the linkages between the environment and the existing operating regime. The past 23 years of reservoir operations provided an opportunity to examine and understand the linkages between the existing operating regime and the environment. Twenty-seven working hypotheses that clearly defined the preliminary assumptions about linkages between each VEC and the operating regime were tested. With few exceptions, all hypotheses are related to Aishihik Lake levels. This was assumed to be the primary physical change induced by the operating regime that would show some link to the ecosystem.

Each hypothesis was rigorously examined, and assumptions about the causal link to the operating regime were explicitly defined. The scientific and socioeconomic studies provided the necessary information to prove, or disprove the hypothesis, and in many cases refine the assumptions. The conclusions as to the validity of each hypothesis were grouped in three distinct categories, as follows:

- where a direct linkage to the operating regime was found to exist, the hypothesis was considered to be valid. The answer to the first CEAA question "Are the environmental effects adverse?" was assumed to be Yes. Fifteen hypotheses were found to be valid, and were examined further in the impact assessment.
- where no linkage to the operating regime was found to exist, the hypothesis was considered to be invalid, and it was assumed that there is no adverse effect attributable to the operating regime. Nine hypotheses were found to be invalid, and were not considered further in the impact assessment.

- where the cause and effect relationship is linked to the original shift from natural to a regulated regime, but which is independent of the existing operating regime, or is linked to some other aspect of the facility, the hypothesis was considered to be invalid. No further assessment of these ten hypotheses was undertaken in the impact assessment, though the impact management plan does address some of these effects.

IMPACT ASSESSMENT

CEAA Framework and Methodology

Only those VEC's that were found to be adversely affected by the operating regime were considered further in the impact assessment. Following the CEAA framework, the overall significance of impact is assessed by answering three questions, in this order:

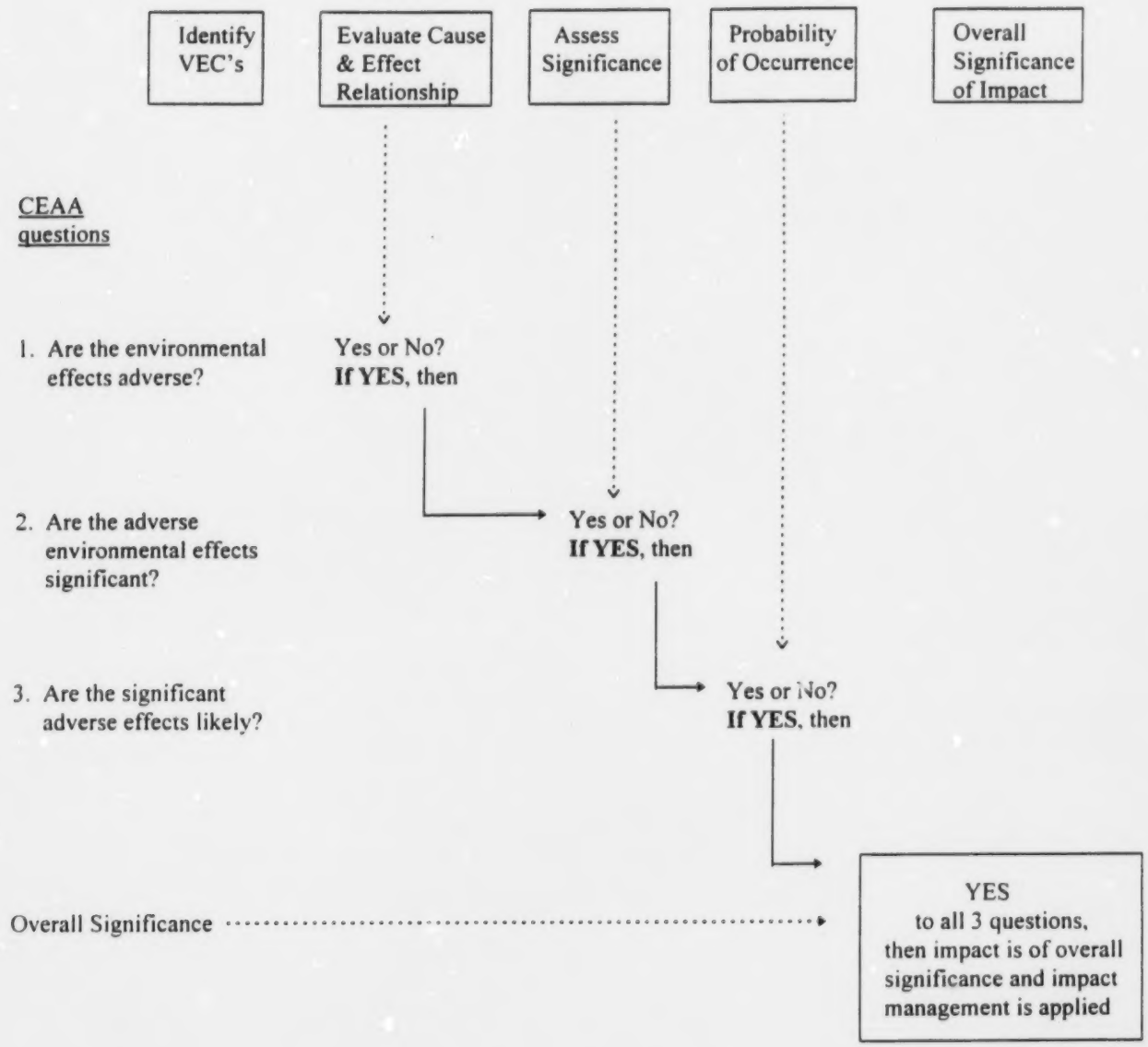
1. Are the environmental effects adverse?
2. Are the adverse effects significant?
3. Are the significant adverse effects likely?

An impact is considered to be of overall significance if the answer to all three questions is Yes. The following figure illustrates the approach used to assess overall significance of impact in this assessment.

As in any impact assessment, however, the specific characteristics of a project must be considered in refining the methodology until it serves the intended purpose. One specific characteristic of this impact assessment is the use of precisely defined scenarios of reservoir operation to compare the effect of different operating regimes on the ecosystem.

Operating Scenarios

A scenario is a mathematical simulation of how the Aishihik reservoir might operate, assuming various combinations of inflows, operating rules, and demand for electricity. In order to simulate these scenarios, a hydrological model was developed that simulates the operation of the WAF system over a 25 year time span, from 1997 to 2021. For each scenario, the model took account of any restriction to operations that would occur at Aishihik given changes in storage range, operating constraints, and load conditions, and estimated the energy load for each month during that time frame. The scenarios included in the impact assessment are given in the table below.


Identify VEC's
Evaluate Cause & Effect Relationship
Assess Significance
Probability of Occurrence
Overall Significance of Impact
CEAA questions
1. Are the environmental effects adverse?
Yes or No?
If YES, then
2. Are the adverse environmental effects significant?
Yes or No?
If YES, then
3. Are the significant adverse effects likely?
Yes or No?
If YES, then
Overall Significance
YES
to all 3 questions, then impact is of overall significance and impact management is applied

Impact Assessment Process

Aishihik Lake Operating Scenarios

Scenario	Type of Regime	Third Turbine	Storage Range	Full Supply Level (m)	Low Supply Level (m)	Operating Constraints
1	existing storage range	no	2.74m (9 ft)	915.16	912.42	
2	maintain storage range	yes	2.74m (9 ft)	915.16	912.42	
3	natural range	yes	1.02m (3.34 ft)	915.16	914.25	
4	reduced storage	yes	2.44m (8 ft)	915.16	912.72	
5	reduced storage	yes	2.13m (7 ft)	915.16	913.03	
6	reduced storage	yes	1.83m (6 ft)	915.16	913.33	
7	existing storage range restricted outflow by zone	yes	2.74m (9 ft)	915.16	912.42	top 1.52m @ 100% output, next 0.61m @ 50% output, last 0.61m @ 25% output
8	existing storage range operating constraints	yes	2.74m (9 ft)	915.16	912.42	If above 913 m in Mar/Apr. no restrictions on operation. If below 913 m in Mar/Apr. for 3 years in 10 constrain to 2.13 m range. (LSL raised to 913.03 m)
9	existing storage range, operating constraints	yes	2.74m (9 ft)	915.16	912.42	If above 913 m in Mar/Apr. no restrictions on operation. If below 913.m in Mar/Apr. for 5 years in 10 constrain to 2.13 m range. (LSL raised to 913.03 m)

The model produced two outputs: the energy and capacity available from Aishihik, and the pattern of monthly water levels and outflows for Aishihik Lake over the period of simulation. The results of the model are presented in both tabular or graphical format and statistical analyses of the results were performed.

Impact Thresholds

The specific lake elevation, or range of elevations, above or below which an adverse effect could occur has been determined by the studies. These specific lake levels, occurring at particular times of the year, for a particular duration or frequency, or that occur for several consecutive years, are factors that, in combination, define an impact threshold. An impact threshold is a limit beyond which the change induced by a project poses an unacceptable level of risk. Impact thresholds, therefore, are described in terms of the probability of a critical combination of events, assuming a specified operating scenario and load forecast. Impact thresholds were defined for those VEC's where an adverse relationship to the operating regime has been demonstrated. These impact thresholds are described in detail in Chapter 7.

Determination of Significance

Determination of significance involves professional judgment and subjectivity. In an attempt to bring some precision to the term, a set of measures of significance (CEAA, 1994; CEAA, 1997) have been gaining general acceptance. The measures of significance used for this study are:

- geographic extent *Over how large an area does the adverse effect occur?*
- duration *Once triggered, how long do the adverse effects last?*
- frequency *How often do the impact thresholds occur during the term of renewed license?*
- magnitude *Relative to the study area, how big is the effect?*

In this assessment, numerical scores from 0 to 4 were assigned to represent different levels of significance. The following table indicates how several measures of significance were factored equally into the assessment of significance. By adding the scores for each measure of significance, total scores ranging from a minimum score of 0 to a maximum score of 16 were possible. For the purposes of this impact assessment, any effects that had a total score of 9 or more are termed significant. This represents the mid-point in the scoring range, thereby avoiding screening out impacts that merit further consideration.

Framework for Assessment of Significance

LEVEL OF SIGNIFICANCE	GEOGRAPHIC EXTENT	TEMPORAL	EXTENT	MAGNITUDE
		DURATION	FREQUENCY	
4	regional	very long term	continuous	very large
3	watershed	long term	common	large
2	local	medium term	uncommon	medium
1	site	short term	rare	small
0	none	none	never	nil

Using this methodology, the predicted significance of effects was determined for each scenario, for both the low and medium load forecasts. Only those effects that were determined to be significant (i.e. with a total score of 9 or more) were assessed further to determine the likelihood of the effect occurring under the various scenarios. The results of the assessment of significance for each scenario, assuming a medium load forecast, are summarized in the following table. These results indicate that several VEC's are significant under all scenarios, while others vary with scenario. Bolded scores indicate significant effect.

Significance Scores - All Scenarios - Medium Load Forecast

Valued Ecosystem Component	Sc#1 9 ft.	Sc#2 9 ft.	Sc#3 3 ft.	Sc#4 8 ft.	Sc#5 7 ft.	Sc#6 6 ft.	Sc#9 9 ft.
shoreline erosion- fine-grained permafrost rich	**10**	**10**	**11**	**10**	**10**	**11**	**10**
shoreline erosion - coarse grained no permafrost	7	7	8	7	7	8	7
fish - lake whitefish hatching success	8	9	0	8	5	5	8
birds - habitat use for staging and breeding	8	7	0	7	7	5	7
muskrats - access to food; survival	7	7	0	7	7	7	7
CAFN access to water (north end of lake)	7	8	0	7	7	4	7
CAFN fish harvesting at traditional sites	9	10	0	10	8	6	9
CAFN wildlife harvesting - ponds and shallows	8	8	0	8	7	5	7
drinking water at Aishihik Village	6	7	0	7	6	5	7
recreational access to water (south end of lake)	6	6	0	6	6	0	6
recreation and tourism development potential	7	8	0	7	7	2	7
aesthetics - lakebed exposure	6	7	0	7	6	5	7
cost of energy	**14**	0	**16**	**14**	**14**	**15**	**14**
heritage sites and grave sites - risk of erosion	**10**	**10**	**11**	**10**	**10**	**11**	**10**

Determination of Likelihood

The third CEAA question "Are the significant adverse effects likely?" was answered by a probability analysis. In this assessment, a significant effect was determined to be likely when the probability of exceeding an impact threshold is 50% or more. The hydrologic model provided probability data for each operating scenario and each load forecast. The probability of occurrence of impact thresholds was one of the outputs from the model. The following table gives the probability and likelihood for all scenarios for medium load. These data indicate that some significant effects are likely under all scenarios, whereas others are likely only under certain scenarios (i.e. - fish harvesting).

Probability/Likelihood Assessment - All Scenarios - Medium Load Forecast

Valued Ecosystem Component	Sc#1 9 ft.	Sc#2 9 ft.	Sc#3 3 ft.	Sc#4 8 ft.	Sc#5 7 ft.	Sc#6 6 ft.	Sc#9 9 ft.
shoreline erosion- fine-grained permafrost rich	84% Y	80% Y	100% Y	80% Y	89% Y	91% Y	89% Y
lake whitefish hatching success	27% N	46% N	0% N	36% N	0% N	0% N	11% N
C&AFN fish harvesting at traditional sites	39% N	52% Y	0% N	35% N	20% N	1% N	39% N
cost of energy - effects continuous throughout license term, therefore likely under all scenarios except Scenario 2, the economic base case.	Y	N	Y	Y	Y	Y	Y
heritage sites and grave sites - risk of erosion	84% Y	80% Y	100% Y	80% Y	89% Y	91% Y	89% Y

SELECTION OF A PREFERRED SCENARIO

Selection Criteria

The selection of a preferred scenario was based upon the relicensing objectives. The preferred operating regime will be one that:

- minimizes significant and likely environmental impacts, both at Aishihik Lake and elsewhere in the Yukon (i.e. minimizes diesel generation and the need for new energy supply to offset any reduced energy output from Aishihik);
- maintains the generation capability and operational flexibility to meet existing and future demand for electricity on the WAF system;
- does not exert upward pressure and instability on electrical rates; and
- incorporates appropriate monitoring and mitigative measures to ensure that environmental objectives are met.

Using these criteria, the operating scenarios were compared, and through a process of elimination the preferred scenario was selected. The following table indicates that no scenario emerges as one that can eliminate all significant and likely effects. This comparison was made assuming the medium load forecast, prior to the application of impact management measures.

Comparison of Scenarios 1-6, 9 (Medium Load Forecast) Indicating Impacts of Overall Significance (adverse, significant and likely; shown as Y).

VALUED ECOSYSTEM COMPONENT	SCENARIOS						
	1	2	3	4	5	6	9
Shoreline Erosion (fine-grained, permafrost-rich sediments)	Y	Y	Y	Y	Y	Y	Y
C&AFN Fish Harvesting		Y					
Energy Economics	Y		Y	Y	Y	Y	Y
Heritage Sites and grave sites	Y	Y	Y	Y	Y	Y	Y

Assuming a medium load forecast, the above comparison of scenarios showed that there is little difference between scenarios in terms of the potential for significant and likely effects on shoreline erosion, and the associated risk to heritage sites and grave sites. The comparison also showed that there is little difference between scenarios in terms of the potential for significant and likely effects on C&AFN fish harvesting activities, with the exception of Scenario 2. Under all other scenarios, these effects are either not significant and/or not likely. The assessment of probability/likelihood in the previous table, however, shows that as the storage range is reduced to 6 ft. or less, there is a greater likelihood of erosion, reaching a probability of 100% under scenario 3 (3 ft. range). The likelihood table also shows that the probability of effect on C&AFN fish harvesting and lake whitefish hatch success decreases as the storage range is reduced. Under Scenario 3, such effects would be virtually eliminated as the lake level below which most of

these effects start to occur is lower than the low supply level for scenario 3 (914.25m). Other than scenario 2, which is the economic base case, there would be significant and likely economic effects under all other scenarios resulting from diminished energy and/or capacity available from Aishihik. The magnitude of effect on the cost of energy is greatest for scenario 3, and relatively small for scenarios 1 and 9. The effect on the cost of energy would be continuous throughout the term of the renewed water license, therefore likely.

The results of the impact assessment were predicted for the medium and low load forecasts, as it is assumed that both may occur during the next 25 years. With the real possibility of the Faro mine not reopening, however, it is reasonable to consider the implications of a low load situation more carefully. The nature and frequency of predicted impacts, and thus mitigation and or monitoring efforts may need to adapt to major shifts in load. Given the difficulty of predicting future demand for energy, a key objective in relicensing Aishihik is to maintain maximum operational flexibility under the terms of a renewed license, while ensuring that appropriate mitigation and monitoring are in place to address different environmental circumstances that are triggered under different load conditions.

Scenario 2 emerged as the closest match to the selection criteria outlined above, though it is recognized that not all the selection criteria have been met by this choice. To address this, options for effectively avoiding, or mitigating significant environmental effects are included in the impact management plan, and include measures other than water level management. The options for avoiding or minimizing impacts on the cost of energy, however, are very limited within the context of this relicensing. Other than constructing new energy projects, or replacing hydro with diesel energy, the scenario that best achieves the objectives of maintaining energy supply capability and operational flexibility is scenario 2. This scenario is the basis for the project which maintains the 2.7m storage range at Aishihik Lake, and will incorporate operational constraints to avoid or minimize environmental risk, as indicated through effective monitoring programs.

IMPACT MANAGEMENT PLAN

Objectives of Impact Management

An impact management plan was developed to avoid, reduce or mitigate the severity of significant and likely environmental impacts. For relicensing Aishihik, impact avoidance measures include water management and the choice of an operating regime. The impact assessment included an examination of 7 different operating scenarios, none of which avoided all significant and likely impacts. However, there are opportunities to further avoid impacts through the application of mitigation measures other than water level management. Monitoring and compensation also play an important role in developing an impact management strategy for relicensing Aishihik.

The impacts to be managed can be broadly categorized as high water effects, and low water effects. The frequency and duration of high and low lake levels is a function of load and inflows. The application of mitigation measures must be adaptive to major shifts in load as well as extreme changes in inflows that occur from time to time.

Management of High Water Impacts

The primary objective of managing high water e ts is to reduce the risk of significant shoreline erosion that can be caused by wave action. As shoreline erosion is one of the ways that heritage sites and grave sites can be damaged or lost, actions taken to minimize erosion would also minimize the potential impact on heritage resources at risk from erosion. This risk can be minimized by:

- limiting the amount of time lake levels are maintained at or near FSL, thereby minimizing the risk of concurrent wind/wave action during the open water season; and
- constructing protective berms to stabilize and protect shoreline areas subject to erosion.

Management of Low Water Impacts

Under medium load conditions, periodic occurrences of lake levels below 914 m during the open water season are anticipated. Should thi occur, several adverse effects have been identified, including more difficult access to the lake, increased difficulty to harvest fish, waterfowl and aquatic furbearers, and increased difficulty to obtain drinking water at the Village. The measures proposed to mitigate the effects of low water levels are contingent upon frequent and sustained periods of low water conditions.

Annual monitoring of the lake whitefish fishery is proposed. The objective of the fisheries monitoring program for Aishihik Lake is to detect changes in the lake whitefish population that could lead to unacceptable decline in the existing fishery, and to apply measures early enough to correct such changes. The proposed monitoring program would prov de the necessary information and would also give early warning of the potential for unacceptable effects to the fishery. The monitoring program will include collection of physical data (lake levels, ice thickness and tem rature) as well as population data (abundance, condition, age structure, abundance of the s wning population etc.). The results of the monitoring would be reviewed after the first five years, and at appropriate intervals thereafter. In the event that the five year review indicates an unacceptable rate of decline in the fishery, Aishihik Lake levels would be managed to prevent or minimize future harv loss. Assuming that the impacts are a result of periodic low water effects on the spawning success of lake whitefish, then operational constraints would be implemented to ensure that the lake levels in March and April do not go below 913.7 m more than five years out of any ten year cycle.

Potential impacts on access to the lake will be addressed through construction and/or improvement of boat access. At the north end of the lake, various options for improving access have been identified, including a sectional floating wharf, permanent wharf, gravel ramp and combinations thereof. At the south end of the lake, the existing boat ramp will be extended to accommodate the range of lake levels that may occur from time to time during the open water season.

While improved boat access to the lake may reduce the impact on harvesting activities, it would probably not eliminate it. Many of the traditional harvesting sites around the north end of the

lake and Sekulmun ponds would continue to be adversely affected by frequent or sustained periods of low water levels, should these occur. The issue of past and potential future losses of harvesting opportunity is one of the issues that is being addressed in compensation discussions with Aishihik families.

RESIDUAL IMPACTS OF THE PREFERRED SCENARIO

Under CEAA, the final determination of overall significance of impacts is completed following the application of impact management measures. The goal is to reduce all identified impacts to insignificant levels. The effectiveness of the impact management plan can be confirmed by reassessing the significance and likelihood of impacts having applied the impact management measures. The reassessment of the overall significance of impacts associated with scenario 2 found that all potentially significant impacts could be reduced to insignificant levels.

Conclusion

This study has concluded that scenario 2, coupled with the proposed impact management plan, is the project to be submitted for relicensing. After considerable study, it was determined that scenario 2 is preferred over the other scenarios tested. Potentially significant and likely impacts identified under scenario 2 (assuming medium and low loads) can be rendered insignificant through the application of the proposed impact management measures. Maintaining the existing 2.74 m storage range allows for continued operational flexibility, and is the only available and effective means of avoiding potentially significant effects on the cost of energy. Other significant effects may, or may not, occur, depending on the frequency and duration of certain lake levels. Selected mitigative measures can be implemented if and when conditions dictate. Other measures and monitoring programs will be carried out annually to ensure that management objectives are met.